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A METASTABLE STATE OF AROUND 10^{-6} SECONDS IN Re^{187}

by

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By S. De Benedetti and F. K. McGowan

Using sources of W^{187} (24 hrs) and an experimental arrangement similar to that described in a previous letter[1] we were able to detect delayed coincidences whose number as a function of time is shown in Figure 1. It appears from this curve that the disintegration of W^{187} leads to a metastable state Re^{187} which in turn decays to the ground state with a half-life of about one microsecond (only statistical errors indicated on the figure; errors involved in the calibration of the time scale may be considerably larger).

In order to increase the counting rate by eliminating absorption in the counter windows, the two GM counters and the source (deposited on a thin aluminum foil) were located within the same envelope (Figure 1). Since the minimum delay used was 1.5 μsec, it was necessary to prove that the recorded coincidences were not due to simultaneous rays (immediate internal conversion, or radiation scattered from one to the other counter) which gave delayed pulses because of the time lag of the counters. To test this point, β rays from RaE were sent through both counters and it was found that these did not give any delayed coincidences despite the large number of immediate coincidences recorded.

Absorption measurements were performed under the geometrical conditions described in the previous letter[1] using 2 mica window GM counters. The absorption curve of the disintegration electrons followed by a delayed ray proved that the metastable state follows the softer part of the β spectrum[2] of W^{187}. Some γ radiation also seems to precede the metastable state. From absorption measurements on the delayed electrons, it appears the energy of the delayed γ rays may correspond to any one of the three soft lines (.086, .101, or .130 Mev) previously observed in the spectrum of W^{187}. However, it seems probable that the metastable state is associated to the .130 Mev transition since this has been observed with a β spectrometer to be strongly converted.[3]

The disintegration of the metastable state is accompanied by a soft electromagnetic radiation (less than 100 Kv) which could be either the unconverted γ ray from the metastable state (which in this case should be attributed to the 86 Kv transition), or a γ ray following it, or the atomic X-radiation from Re. The number of delayed electrons per disintegration of W^{187} was evaluated to 0.1. Since not all β rays of W^{187} lead to the metastable state, the internal conversion coefficient must be larger than this value.

This work was done under the auspices of the Manhattan District.

REFERENCES

1. De Benedetti, S., and F. K. McGowan, Phys. Rev. 70: 569 (1946).

2. Sullivan, W. H., Phys. Rev. 68: 277 (1945).

3. We are indebted to L. C. Miller and L. F. Curtiss for the communication of this result.

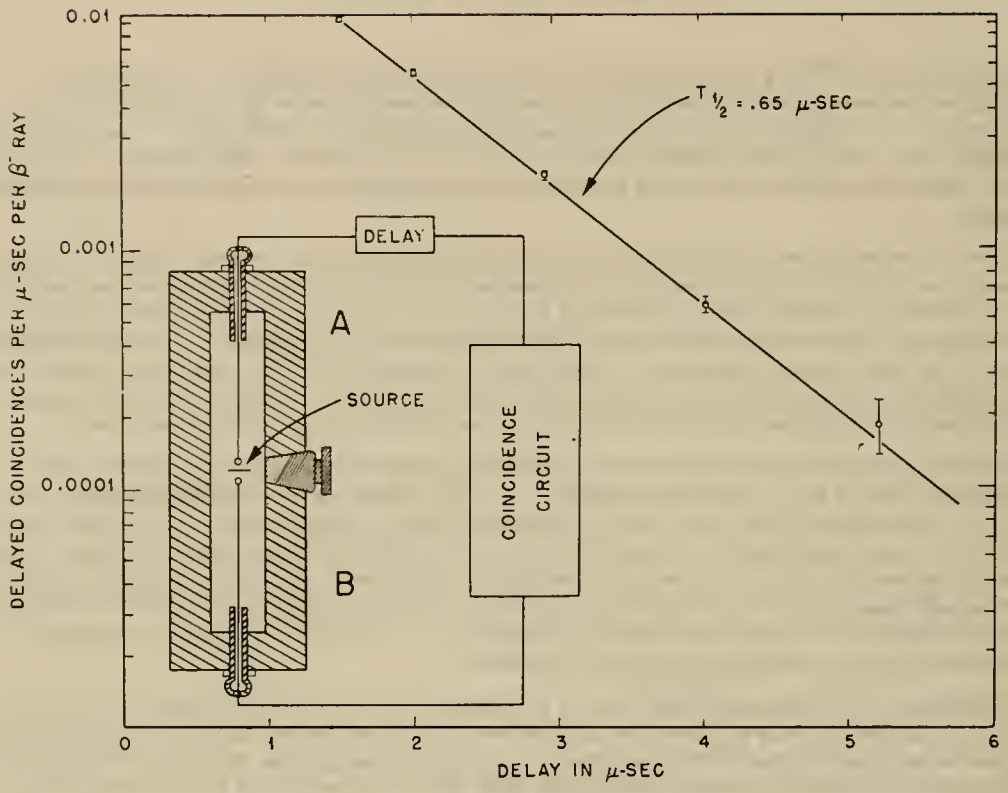
0.01
0.001
0.0001
DELAYED COINCIDENCES PER μ-SEC PER β⁻ RAY
T ½ = .65 μ-SEC
DELAY
A
SOURCE
B
COINCIDENCE CIRCUIT
0
1
2
3
4
5
6
DELAY IN μ-SEC

Figure 1.

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